Equipment For Mechanical Machining, In Particular For The Turning And Drilling Of Light Alloy Wheels

Technical scope

This invention relates to equipment for mechanical machining, and in particular for turning and drilling light alloy wheels.

Technical Background

In the specific technical field of the manufacture of light alloy wheels, of aluminium alloy in particular, the mechanical machining which is mainly required on these metal parts comprises turning and drilling in accordance with predetermined working cycles.

These working cycles generally comprise rather short cycle times, of the order of a few minutes, in which the effect of the time during which tools are moved (otherwise known as the "changeover time") and the time for loading/unloading the workpieces is rather substantial in comparison with the actual time for which the machine tools are working in the overall cycle time. By way of example it may be noted that this may amount to even 30% and more of the machining cycle time in the case of cycle times of the order of approximately 1 minute.

It is also obvious that as the specified cycle times are reduced (as a result, for example, of reduced working times for the removal of turnings), because the changeover and loading/unloading times remain substantially unchanged this effect increases in proportion, penalizing the overall productivity of the machining equipment.

Brief Summary Of The Invention

A principal object of the invention is to provide machining equipment which has been specially designed for the drilling and turning of light alloy wheels with characteristics which drastically reduce the effect of dead times, which

are understood to be the times involved in accessory operations (changeover times and workpiece loading/unloading times), during which no mechanical machining with the removal of turnings takes place, in comparison with overall cycle times, with a consequent advantageous increase in the overall productivity of the equipment.

This object and others which will appear below in the description are accomplished by equipment for mechanical machining constructed in accordance with the appended claims.

Brief Description Of The Drawings

Other advantages and characteristics of the present invention will become clear from the following detailed description which is given with reference to the appended drawings which are provided purely by way of non-limiting example and in which:

- Figure 1 is a diagrammatical front elevation view of mechanical machining equipment according to the invention,
- Figure 2 is a diagrammatical view in plan of the equipment in Figure 1,
- Figure 3 is a diagrammatical side elevation view of the equipment in the preceding figures.

Preferred Embodiment Of The Invention

With reference to the figures mentioned, 1 indicates as a whole mechanical machining equipment for turning and drilling wheels 2 of light alloy, especially aluminium alloy, constructed in accordance with this invention.

Equipment 1 comprises a turning unit 3 combined with a drilling unit 4, the working areas of which are indicated by A and B respectively in Figure 2 (with a double dotted and dashed line).

Turning unit 3 comprises a base 5 on which is provided a pair of chucks 6, 7 with corresponding axes of rotation X, X' to support workpieces (wheels 2)

undergoing machining and a turning head 8 designed to work in association with one or other of chucks 6, 7 alternately. More particularly, head 8 comprises an erect upright 9 from base 5 on which are provided guide and control means for a tool-holding slide 10 which can make guided movements away from and towards chucks 6, 7 along a direction parallel to an axis Y perpendicular to axes X, X' so that turning head 8 can work in the area of one or other of chucks 6, 7 alternately.

Chucks 6, 7 are also served by a single slide for rotation of the workpiece being machined. 11 indicates a first workpiece loading/unloading device, which forms part of a system for moving the workpieces and extends within working areas A and B through a magazine 12 from which wheels 2 requiring machining are taken and a station 13 for unloading machined wheels 2.

Conveniently the movement system is constructed with vertical uprights 14 which are designed to support a beam 15 lying above working units 3, 4 and incorporating guide means to guide device 11 in the corresponding working area. Beam 15 extends longitudinally between magazine 12 and unloading station 13.

Device 11 comprises an arm 16 which can move transversely in the direction of movement of the device along beam 15, approaching/moving away from chucks 6, 7 for the operations of loading/unloading wheels 2 from turning unit 3. Preferably arm 11a has a handling device 17 at one end which is designed to seize wheels 2.

Drilling unit 4, associated with working area B, is operatively associated with turning unit 3 and comprises a corresponding base 18 on which first and second workpiece-holding devices, indicated by 19 and 20 respectively, are located. Drilling unit 4 also comprise a pair of drilling heads 21, 22, each of which is provided with a corresponding tool-holding turret 21a, 22a capable of

performing at least three working movements in three corresponding controlled axes and associated with a corresponding tool magazine, which is not shown. Heads 21, 22 are incorporated in drilling unit 4 so that either each can work with its corresponding workpiece-holding device or both can work on the same device in order in this second situation to carry out corresponding and separate drilling operations in one working cycle in which one head is being fitted with a tool to carry out subsequent drilling operations at the same time as the other drilling head is actively engaged in machining wheel 2.

It is also provided that drilling heads 21, 22 are further incorporated into working unit 4 so as to carry out different drilling operations in one working cycle on a wheel 2 supported in one of devices 19, 20 at the same time as the workpiece is being loaded onto/unloaded from the other device.

In this respect the equipment comprises a second workpiece loading/unloading device, indicated by 23, which is structurally and functionally identical to device 11, and correspondingly incorporates an arm 24 with a handling member 25 for grasping wheels 2. In the same way as in the case of device 11, device 23 is guided along beam 15 to move the wheels in the operations of loading/unloading from workpiece-holding devices 19, 20 and taking wheels 2 from magazine 12 and transferring them to the working area appropriate for turning operations, and vice versa.

Conveniently devices 11, 23 are incorporated into equipment 1 for moving workpieces (wheels 2) which are being machined from and towards one or other of machining units 3, 4 so that the mechanical operations of drilling and turning take place at the same time as the operations of loading/unloading from the workpiece-holding devices and the chucks, and at the same time as the stages in which the machining heads are fitted.

In operation, initially with reference to working area A in which turning is performed, it is provided that while turnings are being removed from the wheel supported in one of chucks 6, 7 a workpiece is loaded onto and unloaded from the other chuck at the same time using device 11. In this way the stages of acceleration/deceleration of one of the chucks before and after the stages of tool fitting takes place in a concealed time during which turnings are at the same time removed from the piece gripped in the other chuck. It follows that chucks 6, 7 are not therefore substantially affected by dead times, by which times are meant the times required for loading/unloading workpieces, the times for accelerating/decelerating the chuck and the times for changing tools.

Similarly, with reference to working area B where drilling is performed, drilling operations are carried out on a wheel secured on one of devices 19, 20 while a machined workpiece is at the same time loaded onto/unloaded from the other device 19, 20 using means 11, 23. Again in this case therefore dead times are concealed in that the loading/unloading and tool-fitting times for one device are at the same time effective machining time with the removal of turnings for the other device. It is provided that the drilling operations in one cycle are performed by only one of the two drilling heads or both. In the latter case, while one of heads 19, 20 performs the drilling operation, the other head is fitted with a new tool so that it can perform the next drilling operation.

When both heads 19, 20 complete the drilling operation specified in the working cycle, they are moved in the direction of the adjacent workpiece-holding device in order to carry out a further machining cycle.

It will be noted that in equipment 1 workpieces can be machined with appropriate checks first in turning unit 3 and then in drilling unit 4 or vice

versa, the machining heads and the loading/unloading devices being designed to work in both ways indicated.

It will also be noted that the use of two drilling heads incorporated into machining unit 4 makes it possible to use tool-changing mechanisms of a substantially simple type with every advantage in ease of handling and control of the machining unit.

The invention thus achieves the objects specified, providing many advantages in comparison with known solutions.

Firstly, the equipment according to the invention makes possible a substantial reduction in dead times during the working cycle, in the meaning of the term indicated above, with an advantageous increase in productivity in comparison with known applications.

In particular the equipment according to the invention makes it possible to achieve a drastic reduction in the effect of loading/unloading times and the time for tool fitting and movement of the tool/workpiece-holding table within the overall cycle time so that cycle times are not governed by these accessory operations in relation to the actual time for the removal of turnings specified in the working cycle.

Furthermore, as a result of the features of the equipment according to the invention, the machine tools provided in the machining units are not subjected to machine shutdowns for operations other than actual machining operations with the removal of turnings, with a consequent maximization of productivity.

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Chucks 6, 7 are also served by a single slide for rotation of the workpiece being machined. 11 indicates a first workpiece loading/unloading device, which forms part of a system for moving the workpieces and extends within working areas A and B through a magazine 12 from which wheels 2 requiring machining are taken and a station 13 for unloading machined wheels 2.

Conveniently the movement system is constructed with vertical uprights 14 which are designed to support a beam 15 lying above working units 3, 4 and incorporating guide means to guide device 11 in the corresponding working area. Beam 15 extends longitudinally between magazine 12 and unloading station 13.

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Conveniently devices 11, 23 are incorporated into equipment 1 for moving workpieces (wheels 2) which are being machined from and towards one or other of machining units 3, 4 so that the mechanical operations of drilling and turning take place at the same time as the operations of loading/unloading

from the workpiece-holding devices and the chucks, and at the same time as the stages in which the machining heads are fitted.

In operation, initially with reference to working area A in which turning is performed, it is provided that while turnings are being removed from the wheel supported in one of chucks 6, 7 a workpiece is loaded onto and unloaded from the other chuck at the same time using device 11. In this way the stages of acceleration/deceleration of one of the chucks before and after the stages of tool fitting takes place in a concealed time during which turnings are at the same time removed from the piece gripped in the other chuck. It follows that chucks 6, 7 are not therefore substantially affected by dead times, by which times are meant the times required for loading/unloading workpieces, the times for accelerating/decelerating the chuck and the times for changing tools.

Similarly, with reference to working area B where drilling is performed, drilling operations are carried out on a wheel secured on one of devices 19, 20 while a machined workpiece is at the same time loaded onto/unloaded from the other device 19, 20 using means 11, 23. Again in this case therefore dead times are concealed in that the loading/unloading and tool-fitting times for one device are at the same time effective machining time with the removal of turnings for the other device. It is provided that the drilling operations in one cycle are performed by only one of the two drilling heads or both. In the latter case, while one of heads 19, 20 performs the drilling operation, the other head is fitted with a new tool so that it can perform the next drilling operation.

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